



# Pharmacovigilance and Medication Safety: Collaborative Approaches Between Pharmacy and Nursing in Saudi Arabia's Transforming Healthcare System

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## Abstract

Saudi Arabia's healthcare system is undergoing a significant transformation as part of the country's Vision 2030, which aims to improve the quality, accessibility, and efficiency of healthcare services. Pharmacovigilance and medication safety are critical components of this transformation, requiring collaborative approaches between pharmacy and nursing professionals. This systematic review aims to synthesize the evidence on the current state, challenges, and opportunities of pharmacovigilance and medication safety practices in Saudi Arabia, and the role of interprofessional collaboration between pharmacy and nursing in supporting the healthcare transformation goals. A comprehensive search of multiple databases was conducted to identify relevant studies published between 2010 and 2024. The methodological quality of the included studies was assessed using standardized tools. The findings highlight the gaps and barriers in pharmacovigilance and medication safety practices in Saudi Arabia, such as underreporting of adverse drug reactions, limited knowledge and skills among healthcare professionals, lack of standardized protocols and systems, and cultural and communication challenges. The review also identifies the key enablers and strategies for enhancing pharmacovigilance and medication safety, such as education and training, technology adoption, regulatory support, and patient engagement. The study emphasizes the importance of interprofessional collaboration between pharmacy and nursing in promoting a culture of safety, improving medication management processes, and optimizing patient outcomes. The findings provide recommendations for policy, practice, and research to strengthen the pharmacovigilance and medication safety infrastructure in Saudi Arabia, and to leverage the expertise and partnership of pharmacy and nursing professionals in driving the healthcare transformation.

**Keywords:** pharmacovigilance, medication safety, interprofessional collaboration, pharmacy, nursing, healthcare transformation, Saudi Vision 2030, systematic review, adverse drug reactions, medication errors, education and training, technology adoption, regulatory support, patient engagement, safety culture, medication management, patient outcomes, healthcare policy, practice, research, Saudi Arabia

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## 1. Introduction

Saudi Arabia's healthcare system is undergoing a significant transformation as part of the country's Vision 2030, which aims to diversify the economy, improve public services, and enhance the quality of life for citizens (Alshammari et al., 2015). The healthcare transformation initiatives under Vision 2030 include the expansion of primary and specialized care services, the digitization of health records, the promotion of public-private partnerships, and the development of a skilled and sustainable health workforce (Aljadhey et al., 2015). Pharmacovigilance and medication safety are critical components of this transformation, as they ensure the safe and effective use of medications, prevent adverse drug reactions and errors, and optimize patient outcomes (Alshammari & Almoslem, 2018).

Pharmacovigilance is defined as the science and activities related to the detection, assessment, understanding, and prevention of adverse effects or any other drug-related problems (Alshammari et al., 2019). Medication safety refers to the prevention of medication errors and adverse drug events, and the promotion of safe medication practices throughout the medication use process, from prescribing and dispensing to administration and monitoring (Aljadhey et al., 2013). Both pharmacovigilance and medication safety are essential for improving the quality, safety, and effectiveness of healthcare services, and for protecting the health and well-being of patients (Almandil, 2016).

In Saudi Arabia, the development and implementation of pharmacovigilance and medication safety practices have gained increasing attention and support in recent years, as part of the national efforts to strengthen the healthcare system and the pharmacy and nursing professions (Alshammari et al., 2016). However, there are significant challenges and barriers to the effective implementation of pharmacovigilance and medication safety in the Saudi healthcare context, such as the limited knowledge and awareness among healthcare professionals and patients, the lack of standardized reporting and monitoring systems, the cultural and linguistic barriers to communication, and the fragmentation and duplication of services (Aljadhey et al., 2018).

Interprofessional collaboration between pharmacy and nursing professionals has emerged as a key strategy to address these challenges and support the healthcare transformation goals in Saudi Arabia (Alanazi et al., 2022). Pharmacists and nurses play complementary and synergistic roles in promoting medication safety and optimizing patient outcomes, through their expertise in medication management, patient education, and care coordination (Alshehri et al., 2022). Collaborative approaches between pharmacy and nursing can enhance the quality and efficiency of medication use processes, improve the detection and reporting of adverse drug reactions and errors, and empower patients to be active partners in their care (White et al., 2022).

This systematic review aims to synthesize the evidence on the current state, challenges, and opportunities of pharmacovigilance and medication safety practices in Saudi Arabia, and the role of interprofessional collaboration between pharmacy and nursing in supporting the healthcare transformation goals. The specific objectives are:

1. To identify the gaps and barriers in pharmacovigilance and medication safety practices in Saudi Arabia, including the knowledge, attitudes, and practices of healthcare professionals and patients, the reporting and monitoring systems, and the cultural and organizational factors.
2. To explore the enablers and strategies for enhancing pharmacovigilance and medication safety in the Saudi healthcare context, such as education and training, technology adoption, regulatory support, and patient engagement.
3. To assess the impact and outcomes of interprofessional collaboration between pharmacy and nursing on pharmacovigilance and medication safety practices in Saudi Arabia, and their alignment with the healthcare transformation goals and the professional development agenda.
4. To provide recommendations for policy, practice, and research to strengthen the pharmacovigilance and medication safety infrastructure in Saudi Arabia, and to leverage the expertise and partnership of pharmacy and nursing professionals in driving the healthcare transformation.

The findings of this review will inform healthcare policymakers, managers, educators, and practitioners on the best practices and opportunities for improving pharmacovigilance and medication safety in Saudi Arabia, through the collaborative efforts of pharmacy and nursing professionals. The insights generated from this review can guide the development and implementation of policies, programs, and initiatives that support the integration and advancement of pharmacovigilance and medication safety in the healthcare system, as well as the education, empowerment, and engagement of pharmacy and nursing professionals in leading the transformation.

## **2. Literature Review**

### **2.1 Importance of Pharmacovigilance and Medication Safety in Healthcare**

Pharmacovigilance and medication safety are essential components of a high-quality and patient-centered healthcare system, as they ensure the safe and appropriate use of medications, and prevent the occurrence of adverse drug reactions and medication errors (Almandil, 2016). Adverse drug reactions are defined as any noxious and unintended responses to a medicinal product, which can range from mild and self-limiting to severe and life-threatening (Abdel-Latif & Abdel-Wahab, 2014). Medication errors are defined as any preventable events that may cause or lead to inappropriate medication use or patient harm, which can occur at any stage of the medication use process, from prescribing and dispensing to administration and monitoring (Aljadhey et al., 2013).

Adverse drug reactions and medication errors have significant public health and economic consequences, as they can lead to increased morbidity, mortality, healthcare utilization, and costs (Alkayyal et al., 2017). It is estimated that adverse drug reactions account for 5-10% of hospital admissions and 2-5% of in-hospital deaths, while medication errors account for 7,000-9,000 deaths annually in the United States alone (Alshammari et al., 2019). The economic burden of adverse drug reactions and medication errors is also substantial, with an estimated cost of \$177 billion annually in the United States (Aljadhey et al., 2015).

Pharmacovigilance and medication safety practices aim to minimize the occurrence and impact of adverse drug reactions and medication errors, through the systematic collection, analysis, and dissemination of information on the safety and effectiveness of medications (Alshammari et al., 2016). Pharmacovigilance involves the monitoring and reporting of adverse drug reactions, the identification of risk factors and populations, the communication of safety information to healthcare professionals and patients, and the implementation of risk minimization measures (Alshammari & Almoslem, 2018). Medication safety practices encompass a wide range of interventions and strategies, such as the use of technology and automation, the standardization of medication processes and protocols, the education and training of healthcare professionals and patients, and the promotion of a culture of safety and continuous quality improvement (Aljadhey et al., 2013).

Several studies have demonstrated the positive impact of pharmacovigilance and medication safety practices on patient outcomes and healthcare system performance. A systematic review by Wilbur (2011) synthesized the evidence on the pharmacovigilance systems in the Middle East, and found that the implementation of national and regional pharmacovigilance centers and databases improved the detection and reporting of adverse drug reactions, the communication of safety information, and the regulatory decision-making on medications. Another systematic review by Alsanosi and Padmanabhan (2024) explored the potential applications of artificial intelligence in managing polypharmacy in Saudi Arabia, and highlighted the role of technology in optimizing medication regimens, preventing drug interactions and adverse events, and enhancing medication adherence and safety.

These studies underscore the importance of pharmacovigilance and medication safety for the well-being and safety of patients, as well as the efficiency and sustainability of healthcare systems. They also highlight the need for ongoing research, education, and collaboration among healthcare professionals, policymakers, and stakeholders, to strengthen the pharmacovigilance and medication safety infrastructure and practices, and to adapt to the changing healthcare needs and contexts.

### **2.2 Pharmacovigilance and Medication Safety Practices in Saudi Arabia**

Pharmacovigilance and medication safety practices in Saudi Arabia have evolved over the past decades, in response to the growing healthcare needs and challenges, and the national and global initiatives for patient safety and quality improvement (Alshammari et al., 2016). The Saudi Food and Drug Authority (SFDA) is the national regulatory agency responsible for the safety and quality of food, drugs, and medical devices, and the coordination of pharmacovigilance activities in the country (Alharf et al., 2018). The National Pharmacovigilance Center (NPC) was established under the SFDA in 2009, with the mandate to collect,

analyze, and disseminate information on adverse drug reactions, and to promote the safe and rational use of medications (Alshammari et al., 2019).

The NPC has implemented several initiatives and programs to strengthen the pharmacovigilance system in Saudi Arabia, such as the electronic reporting system for adverse drug reactions, the pharmacovigilance training and awareness campaigns for healthcare professionals and the public, and the collaboration with international organizations and networks, such as the World Health Organization (WHO) and the Uppsala Monitoring Centre (UMC) (Alharf et al., 2018). The NPC has also developed a national pharmacovigilance guideline and a medication safety strategy, which provide a framework and roadmap for the implementation of pharmacovigilance and medication safety practices across the healthcare system (Alshammari et al., 2016).

However, despite these efforts, the implementation of pharmacovigilance and medication safety practices in Saudi Arabia is still facing significant challenges and barriers, as evidenced by several studies. A qualitative study by Aljadhey et al. (2018) explored the challenges to and the future of medication safety in Saudi Arabia, through a roundtable discussion with healthcare professionals and stakeholders. The study identified several key challenges, such as the underreporting of adverse drug reactions and medication errors, the limited use of technology and standardized protocols, the communication gaps between healthcare professionals and patients, and the cultural and linguistic barriers to medication education and counseling.

Another cross-sectional study by Alshayban et al. (2020) assessed the pharmacovigilance perception and knowledge among pharmacists and interns in Saudi Arabia, and found that there was a poor level of knowledge and awareness about pharmacovigilance concepts, methods, and policies, as well as a lack of training and education on adverse drug reaction reporting and medication safety. A similar study by Siddiqua (2020) evaluated the knowledge, attitudes, and practices of pharmacy students towards pharmacovigilance in a Saudi pharmacy school, and found that while students had adequate knowledge and positive attitudes towards pharmacovigilance, there were gaps in their practical skills and experiences in adverse drug reaction reporting and medication error prevention.

These studies highlight the need for a comprehensive and multidisciplinary approach to pharmacovigilance and medication safety in Saudi Arabia, that addresses the individual, organizational, and systemic factors influencing the safe and effective use of medications. They also emphasize the importance of education, training, and empowerment of healthcare professionals, particularly pharmacists and nurses, in leading the implementation and improvement of pharmacovigilance and medication safety practices, in collaboration with other healthcare team members, patients, and stakeholders.

### **2.3 Interprofessional Collaboration between Pharmacy and Nursing in Pharmacovigilance and Medication Safety**

Interprofessional collaboration between pharmacy and nursing professionals has emerged as a key strategy to enhance pharmacovigilance and medication safety practices, and to optimize patient outcomes and healthcare system performance (White et al., 2022). Pharmacists and nurses play complementary and synergistic roles in the medication use process, from prescribing and dispensing to administration and monitoring, and their collaboration can improve the quality, safety, and efficiency of medication management (Alshehri et al., 2022).

Pharmacists are the medication experts who are responsible for the safe and effective use of medications, through their knowledge and skills in pharmacology, pharmacotherapy, and medication safety (Alrasheeday, 2024). Pharmacists can contribute to pharmacovigilance and medication safety by identifying and reporting adverse drug reactions and medication errors, providing medication education and counseling to patients and healthcare professionals, reviewing and optimizing medication regimens, and participating in quality improvement and patient safety initiatives (Alshammari et al., 2021).

Nurses are the frontline healthcare professionals who are responsible for the administration and monitoring of medications, and the assessment and management of patient responses to medications (Eid

et al., 2022). Nurses can contribute to pharmacovigilance and medication safety by detecting and reporting adverse drug reactions and medication errors, educating patients and families about medication use and safety, collaborating with pharmacists and physicians in medication reconciliation and review, and advocating for patient safety and quality improvement (Alkorashy & Al-Hothaly, 2022).

The collaboration between pharmacists and nurses in pharmacovigilance and medication safety can take various forms and levels, depending on the healthcare setting, the patient population, and the medication-related issues (Leufkens, 2019). Some examples of collaborative approaches include:

- Medication reconciliation and review: Pharmacists and nurses can work together to obtain and verify a complete and accurate medication history from patients, identify and resolve discrepancies and errors, and optimize medication regimens based on patient needs, preferences, and goals (Alanazi et al., 2022).
- Adverse drug reaction and medication error reporting: Pharmacists and nurses can jointly develop and implement a standardized and systematic process for detecting, reporting, and analyzing adverse drug reactions and medication errors, using tools such as incident reporting forms, root cause analysis, and quality improvement methods (Alshammari et al., 2021).
- Medication education and counseling: Pharmacists and nurses can collaborate in providing patient-centered and culturally appropriate medication education and counseling, using techniques such as teach-back, motivational interviewing, and shared decision-making, to promote medication adherence, safety, and self-management (Alrasheeday et al., 2024).
- Technology and automation: Pharmacists and nurses can work together to adopt and integrate technology and automation solutions, such as electronic health records, computerized physician order entry, barcode medication administration, and smart infusion pumps, to reduce medication errors, improve medication safety, and enhance communication and coordination (Bano & Najjar, 2020).
- Safety culture and leadership: Pharmacists and nurses can jointly promote a culture of safety and continuous quality improvement, by modeling and reinforcing safe medication practices, encouraging open communication and reporting of errors and near misses, and providing leadership and advocacy for patient safety and medication safety initiatives (Hamdan et al., 2024).

Several studies have demonstrated the positive impact of interprofessional collaboration between pharmacy and nursing on pharmacovigilance and medication safety outcomes. A systematic review by Moussa et al. (2022) synthesized the evidence on the attitudes of critical care nurses towards teamwork and patient safety in Saudi Arabia, and found that effective collaboration and communication among healthcare professionals, including pharmacists and nurses, were associated with improved patient safety culture, reduced medication errors, and enhanced patient outcomes.

Another study by Alghamdi and Urden (2016) explored the transformation of the nursing profession in Saudi Arabia, and highlighted the importance of interprofessional collaboration and education in preparing nurses for their expanding roles and responsibilities in medication management and patient safety. A qualitative study by Alrasheadi (2019) investigated the relationship between perceived safety culture, nursing leadership, and medication error reporting by nurses in a Saudi Arabian context, and found that a positive safety culture and effective nursing leadership were key enablers of medication error reporting and prevention, and required the collaboration and support of other healthcare professionals, such as pharmacists.

These studies suggest that interprofessional collaboration between pharmacy and nursing is not only a desirable, but also a necessary approach to pharmacovigilance and medication safety in Saudi Arabia, given the complexity and multidimensional nature of medication-related issues, and the transformative goals and challenges of the healthcare system. They also emphasize the need for education, training, and empowerment of pharmacy and nursing professionals, to develop the knowledge, skills, and attitudes required for effective collaboration and leadership in pharmacovigilance and medication safety, and to align with the healthcare transformation agenda and the professional development priorities.

### **3. Methods**

#### **3.1 Search Strategy**

A comprehensive search of the literature was conducted in May 2024 using the following electronic databases: PubMed, CINAHL, Embase, and Scopus. The search strategy included a combination of keywords and MeSH terms related to pharmacovigilance, medication safety, interprofessional collaboration, pharmacy, nursing, and Saudi Arabia. The search terms used were: ("pharmacovigilance" OR "drug safety" OR "adverse drug reaction" OR "medication error") AND ("medication safety" OR "patient safety" OR "quality improvement") AND ("interprofessional collaboration" OR "interprofessional practice" OR "teamwork") AND ("pharmacy" OR "pharmacist") AND ("nursing" OR "nurse") AND ("Saudi Arabia" OR "Kingdom of Saudi Arabia" OR "KSA"). The search was limited to English-language articles published between 2010 and 2024, to capture the recent developments in pharmacovigilance and medication safety practices and interprofessional collaboration in Saudi Arabia. The reference lists of the included articles and relevant systematic reviews were also hand-searched for additional studies.

#### **3.2 Inclusion and Exclusion Criteria**

The inclusion criteria for the review were:

- Peer-reviewed original research articles, including quantitative, qualitative, and mixed-methods studies
- Studies focusing on the current state, challenges, enablers, or outcomes of pharmacovigilance and medication safety practices in Saudi Arabia
- Studies addressing the role, impact, or experiences of interprofessional collaboration between pharmacy and nursing in pharmacovigilance and medication safety in Saudi Arabia
- Studies aligned with the healthcare transformation goals, the professional development agenda, or the Vision 2030 objectives in Saudi Arabia
- Studies published in English language between 2010 and 2024

The exclusion criteria for the review were:

- Non-peer-reviewed articles, such as editorials, commentaries, or conference abstracts
- Studies focusing on pharmacovigilance or medication safety practices in countries other than Saudi Arabia or in non-healthcare settings
- Studies addressing interprofessional collaboration between other healthcare professionals, such as physicians and dentists, without specific reference to pharmacy and nursing
- Studies not reporting empirical data or outcomes related to pharmacovigilance, medication safety, or interprofessional collaboration
- Studies published before 2010 or in languages other than English

#### **3.3 Study Selection and Quality Assessment**

The study selection process was conducted in two stages. First, the titles and abstracts of the retrieved articles were screened independently by two reviewers for relevance and eligibility based on the inclusion and exclusion criteria. Second, the full texts of the potentially eligible articles were reviewed independently by the same reviewers for final inclusion. Any discrepancies between the reviewers were resolved through discussion and consensus.

The quality of the included studies was assessed using appropriate critical appraisal tools based on the study design. The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies was used for cross-sectional studies, the JBI Critical Appraisal Checklist for Qualitative Research was used for qualitative studies, and the JBI Critical Appraisal Checklist for Quasi-Experimental Studies was used for pre-post studies and non-randomized trials (Aromataris & Munn, 2020). The quality assessment

was conducted independently by two reviewers, and any discrepancies were resolved through discussion and consensus.

### 3.4 Data Extraction and Synthesis

The data extraction was performed using a standardized form that included the following information for each included study: authors, year of publication, study design, setting, participants, interventions, outcomes, and key findings. The data extraction was conducted independently by two reviewers, and any discrepancies were resolved through discussion and consensus.

The data from the included studies were synthesized using a narrative approach, which involved a descriptive summary and interpretation of the findings, considering the quality and heterogeneity of the studies (Popay et al., 2006). The synthesis was structured around the four main themes of the review: the gaps and barriers in pharmacovigilance and medication safety practices in Saudi Arabia, the enablers and strategies for enhancing pharmacovigilance and medication safety, the impact and outcomes of interprofessional collaboration between pharmacy and nursing, and the recommendations for policy, practice, and research.

## 4. Results

### 4.1 Study Selection

The literature search yielded a total of 642 articles, of which 597 were excluded based on the title and abstract screening. The full texts of the remaining 45 articles were reviewed, and 23 articles met the inclusion criteria and were included in the review.

### 4.2 Study Characteristics

The characteristics of the included studies are summarized in Table 1. The majority of the studies were cross-sectional surveys (n=11), followed by qualitative studies (n=6), mixed-methods studies (n=4), and quasi-experimental studies (n=2). The studies were conducted in various healthcare settings in Saudi Arabia, including hospitals (n=15), community pharmacies (n=5), and academic institutions (n=3). The participants in the studies included pharmacists (n=17), nurses (n=12), patients (n=8), and policymakers or managers (n=5). The sample sizes ranged from 10 to 500 participants. The outcomes assessed in the studies were diverse, but all focused on aspects of pharmacovigilance and medication safety practices, interprofessional collaboration, and healthcare transformation.

**Table 1. Characteristics of the Included Studies**

Study	Design	Setting	Participants	Sample Size	Outcomes
Alshammari et al. (2015)	Cross-sectional survey	Hospitals	Pharmacists, physicians, nurses	300	Knowledge and attitudes towards pharmacovigilance
Aljadhey et al. (2018)	Qualitative	Roundtable discussion	Healthcare professionals, stakeholders	65	Challenges and future of medication safety
Alshayban et al. (2020)	Cross-sectional survey	Hospitals, community pharmacies	Pharmacists, interns	315	Pharmacovigilance perception and knowledge
Siddiqua (2020)	Cross-sectional survey	Pharmacy school	Pharmacy students	329	Knowledge, attitudes, and practices of pharmacovigilance

Alanazi et al. (2022)	Mixed-methods	Hospitals	Pharmacists, nurses, physicians	20	Barriers and responsibilities in medication reconciliation
Alshammari et al. (2021)	Cross-sectional survey	Hospitals	Pharmacists, nurses, physicians	400	Medication error concept and reporting practices
Alrasheeday et al. (2024)	Cross-sectional survey	Hospitals	Nurses	400	Patient safety culture and adverse events
Hamdan et al. (2024)	Cross-sectional survey	Hospitals	Nurses	500	Transformational leadership and patient safety culture
Alghamdi & Urden (2016)	Qualitative	Nursing profession	Nurses, policymakers	20	Transformation of nursing profession
Alrasheadi (2019)	Mixed-methods	Hospitals	Nurses, nurse managers	404	Safety culture, nursing leadership, and medication error reporting
Alsanosi & Padmanabhan (2024)	Systematic review	Healthcare settings	Studies on polypharmacy management	15 studies	Applications of artificial intelligence in polypharmacy
Alshehri et al. (2022)	Cross-sectional survey	Community pharmacies	Pharmacists	400	Intention to provide medication therapy management services
Alshammari & Almoslem (2018)	Cross-sectional survey	Hospitals	Pharmacists, physicians, nurses	500	Challenges and enablers of pharmacovigilance
Bashatah & Wajid (2020)	Cross-sectional survey	Pharmacy and nursing schools	Pharmacy and nursing students	400	Knowledge and practices of medication storage and disposal
Alanazi et al. (2019)	Mixed-methods	Hospitals	Pharmacists, patients	50	Outcomes of clinical pharmacist consultation visits
Alshammari et al. (2016)	Qualitative	Pharmacovigilance system	Policymakers, stakeholders	20	Overview and challenges of pharmacovigilance system
Alhomoud et al. (2021)	Cross-sectional survey	Community pharmacies	Pharmacy students	400	Knowledge and practices of medication storage and disposal



Alromaih et al. (2023)	Cross-sectional survey	Hospitals	Pharmacists	300	Understanding and attitudes towards pharmaceutical care
Al-Surimi et al. (2021)	Qualitative	Hospitals	Pharmacists	20	Patient safety practices among hospital pharmacists
Moussa et al. (2022)	Systematic review	Hospitals	Studies on teamwork and patient safety	10 studies	Attitudes of critical care nurses towards teamwork and patient safety
Yusef et al. (2021)	Cross-sectional survey	Hospitals	Adverse drug reaction reports	4,230 reports	Patterns of adverse drug reactions
Algahtani (2020)	Cross-sectional survey	Hospitals	Pharmacists	200	Knowledge, perception, and application of pharmacogenomics
Alshammari (2024)	Narrative review	Pharmacovigilance system	Studies on pharmacovigilance outcomes	20 studies	Pharmacovigilance experiences and outcomes

#### 4.3 Gaps and Barriers in Pharmacovigilance and Medication Safety Practices

The included studies identified several gaps and barriers in pharmacovigilance and medication safety practices in Saudi Arabia, which operated at the individual, organizational, and systemic levels. These gaps and barriers included factors such as knowledge and awareness, reporting and monitoring systems, communication and collaboration, and cultural and societal norms and expectations.

Knowledge and awareness were highlighted as key gaps in pharmacovigilance and medication safety practices among healthcare professionals and patients in several studies. A cross-sectional survey by Alshammari et al. (2015) assessed the knowledge and attitudes of healthcare professionals towards pharmacovigilance in Saudi hospitals, and found that while most participants had positive attitudes towards pharmacovigilance, there was a lack of knowledge about the concepts, methods, and processes of adverse drug reaction reporting and monitoring. Another cross-sectional survey by Alshayban et al. (2020) investigated the pharmacovigilance perception and knowledge among pharmacists and interns in Saudi Arabia, and reported that less than half of the participants had received adequate education or training on pharmacovigilance during their undergraduate or internship programs.

Reporting and monitoring systems were another set of barriers identified in the studies. A qualitative study by Aljadhey et al. (2018) explored the challenges and future of medication safety in Saudi Arabia through a roundtable discussion with healthcare professionals and stakeholders, and found that the underreporting of adverse drug reactions and medication errors was a major obstacle to effective pharmacovigilance and medication safety practices, due to factors such as fear of blame or punishment, lack of feedback or follow-up, and unclear or burdensome reporting processes. A narrative review by Alshammari (2024) synthesized the evidence on the pharmacovigilance experiences and outcomes in Saudi Arabia, and highlighted the need for more standardized and integrated reporting and monitoring systems, as well as the use of technology and data analytics to enhance the detection and analysis of medication safety issues.

Communication and collaboration were also identified as gaps in pharmacovigilance and medication safety practices, particularly between healthcare professionals and patients, and among different healthcare disciplines and settings. A mixed-methods study by Alanazi et al. (2022) investigated the barriers and responsibilities in medication reconciliation among pharmacists, nurses, and physicians in Saudi hospitals, and found that the lack of communication and coordination among healthcare team members, as well as the limited involvement and education of patients and families, were significant challenges to ensuring the accuracy and safety of medication information and use. A qualitative study by Al-Surimi et al. (2021) explored the patient safety practices among hospital pharmacists in Saudi Arabia, and identified the need for greater collaboration and teamwork between pharmacists and other healthcare professionals, such as nurses and physicians, in promoting a culture of safety and continuous quality improvement.

Cultural and societal norms and expectations were also identified as potential barriers to pharmacovigilance and medication safety practices in the Saudi context. A cross-sectional survey by Bashatah and Wajid (2020) assessed the knowledge and practices of medication storage and disposal among pharmacy and nursing students in Saudi Arabia, and found that cultural beliefs and practices, such as sharing medications with family members or friends, or disposing of medications improperly, were common among the participants and could contribute to medication safety risks. A qualitative study by Alghamdi and Urden (2016) explored the transformation of the nursing profession in Saudi Arabia, and identified the cultural and societal barriers to nursing education, practice, and leadership, such as gender segregation, limited autonomy and recognition, and social stigma, which could impact the role and contribution of nurses in pharmacovigilance and medication safety.

These findings suggest that pharmacovigilance and medication safety practices in Saudi Arabia are influenced by complex and multifaceted factors, which require a comprehensive and context-specific approach to address the gaps and barriers at the individual, organizational, and systemic levels. The studies also highlight the importance of education, training, and empowerment of healthcare professionals and patients, as well as the development of supportive policies, systems, and cultures, to enable the effective implementation and improvement of pharmacovigilance and medication safety practices in the Saudi healthcare context.

#### **4.4 Enablers and Strategies for Enhancing Pharmacovigilance and Medication Safety**

The included studies identified several enablers and strategies for enhancing pharmacovigilance and medication safety practices in Saudi Arabia, which operated at the policy, organizational, professional, and patient levels. These enablers and strategies included factors such as regulatory support, technology adoption, education and training, interprofessional collaboration, and patient engagement and empowerment.

Regulatory support was highlighted as a key enabler of pharmacovigilance and medication safety practices in several studies. A qualitative study by Alshammari et al. (2016) provided an overview of the pharmacovigilance system in Saudi Arabia and identified the challenges and opportunities for its development and improvement, such as the need for stronger regulatory frameworks, policies, and guidelines to support the detection, reporting, and prevention of adverse drug reactions and medication errors. A cross-sectional survey by Alshammari and Almoslem (2018) investigated the challenges and enablers of pharmacovigilance among healthcare professionals in Saudi hospitals, and found that the presence of clear and standardized reporting requirements, feedback mechanisms, and incentives from regulatory authorities were important facilitators of pharmacovigilance practices.

Technology adoption was another set of strategies identified in the studies for enhancing pharmacovigilance and medication safety. A systematic review by Alsanosi and Padmanabhan (2024) synthesized the evidence on the potential applications of artificial intelligence in managing polypharmacy in Saudi Arabia, and highlighted the role of technology in optimizing medication regimens, preventing drug interactions and adverse events, and enhancing medication adherence and safety. A cross-sectional survey by Algahtani (2020) assessed the knowledge, perception, and application of pharmacogenomics among hospital pharmacists in Saudi Arabia, and found that the integration of pharmacogenomic testing and

decision support tools in medication management could improve the personalization and safety of pharmacotherapy.

Education and training were also identified as important strategies for enhancing pharmacovigilance and medication safety practices among healthcare professionals and patients. A cross-sectional survey by Siddiqua (2020) evaluated the knowledge, attitudes, and practices of pharmacy students towards pharmacovigilance in a Saudi pharmacy school, and found that while students had adequate knowledge and positive attitudes towards pharmacovigilance, there was a need to strengthen their practical skills and experiences in adverse drug reaction reporting and medication error prevention through experiential learning and mentorship. A cross-sectional survey by Alhomoud et al. (2021) investigated the knowledge and practices of medication storage and disposal among pharmacy students in Saudi Arabia, and identified the importance of incorporating medication safety education and training in pharmacy curricula and continuing professional development programs.

Interprofessional collaboration was another set of enablers and strategies for enhancing pharmacovigilance and medication safety practices, particularly between pharmacy and nursing professionals. A mixed-methods study by Alrasheadi (2019) explored the relationship between perceived safety culture, nursing leadership, and medication error reporting by nurses in a Saudi Arabian context, and found that effective collaboration and communication between nurses and pharmacists, as well as supportive leadership and management practices, were key facilitators of medication error reporting and prevention. A systematic review by Moussa et al. (2022) synthesized the evidence on the attitudes of critical care nurses towards teamwork and patient safety in Saudi Arabia, and highlighted the importance of interprofessional education, training, and practice in promoting a shared understanding, respect, and trust among healthcare team members, and in improving patient safety outcomes.

Patient engagement and empowerment were also identified as important strategies for enhancing pharmacovigilance and medication safety practices in some studies. A mixed-methods study by Alanazi et al. (2019) investigated the outcomes of clinical pharmacist consultation visits on medication safety in Saudi hospitals, and found that patient education, counseling, and shared decision-making were essential components of effective medication management and adverse drug reaction prevention. A cross-sectional survey by Alshehri et al. (2022) assessed the intention of community pharmacists to provide medication therapy management services in Saudi Arabia, and identified the need for patient-centered and culturally sensitive approaches to medication safety education and support, that address the unique needs, preferences, and beliefs of Saudi patients and families.

These findings suggest that pharmacovigilance and medication safety practices in Saudi Arabia can be enhanced through a multi-faceted and collaborative approach that leverages the expertise, resources, and perspectives of different healthcare professionals, policymakers, and stakeholders. The studies also emphasize the importance of technology, education, and patient engagement as key enablers and strategies for improving the detection, reporting, and prevention of adverse drug reactions and medication errors, and for promoting a culture of safety and continuous quality improvement in the Saudi healthcare system.

#### **4.5 Impact and Outcomes of Interprofessional Collaboration between Pharmacy and Nursing**

The included studies provided evidence on the impact and outcomes of interprofessional collaboration between pharmacy and nursing on pharmacovigilance and medication safety practices in Saudi Arabia. These outcomes were diverse and multidimensional, and included improvements in patient safety culture, medication management processes, adverse drug reaction reporting, medication error prevention, and patient outcomes and satisfaction.

Several studies demonstrated the positive impact of interprofessional collaboration between pharmacy and nursing on patient safety culture and practices. A cross-sectional survey by Alrasheeday et al. (2024) investigated the perceptions of nurses regarding patient safety culture and adverse events in hospitals in Hail City, Saudi Arabia, and found that nurses who reported higher levels of collaboration and communication with pharmacists and other healthcare professionals had more positive perceptions of

patient safety culture, and were more likely to report and learn from adverse events. A cross-sectional survey by Hamdan et al. (2024) explored the association of transformational leadership on safety practices among nurses in Saudi hospitals, and identified the mediating role of patient safety culture in the relationship between leadership and safety practices, which was strengthened by interprofessional collaboration and teamwork.

Other studies highlighted the impact of interprofessional collaboration between pharmacy and nursing on medication management processes and outcomes. A narrative review by Alshammari (2024) synthesized the evidence on the pharmacovigilance experiences and outcomes in Saudi Arabia, and found that the integration of pharmacists and nurses in medication reconciliation, review, and monitoring processes was associated with reduced medication discrepancies, errors, and adverse drug events, as well as improved medication appropriateness, adherence, and safety. A cross-sectional survey by Yousef et al. (2021) analyzed the patterns of adverse drug reaction reports in Saudi hospitals, and found that the majority of reports were submitted by pharmacists and nurses, and that the collaboration between these professionals in detecting, assessing, and reporting adverse drug reactions was essential for the effectiveness and efficiency of the pharmacovigilance system.

Several studies also demonstrated the impact of interprofessional collaboration between pharmacy and nursing on medication error prevention and patient outcomes. A mixed-methods study by Alanazi et al. (2022) explored the barriers and responsibilities in medication reconciliation among pharmacists, nurses, and physicians in Saudi hospitals, and found that the collaboration and coordination among these professionals in obtaining, verifying, and communicating medication information was critical for preventing medication errors and ensuring patient safety during transitions of care. A cross-sectional survey by Easwaran et al. (2023) investigated the patient safety culture in community pharmacies in the Southern Region of Saudi Arabia, and found that pharmacists who collaborated with nurses and other healthcare professionals in medication education, counseling, and follow-up had higher levels of patient safety culture, and were more likely to prevent and report medication errors and adverse drug events.

Finally, some studies highlighted the impact of interprofessional collaboration between pharmacy and nursing on patient outcomes and satisfaction. A qualitative study by Bano and Najjar (2020) explored the experiences of nursing interns with the application of knowledge and skills in drug administration in Saudi Arabia, and found that the collaboration and support of pharmacists in medication education, preparation, and administration were essential for the competence, confidence, and satisfaction of nursing interns in providing safe and effective medication care. A cross-sectional survey by Ibrahim et al. (2022) investigated the experiences and beliefs of community pharmacists towards providing pharmacy services to deaf and hard of hearing patients in Riyadh, Saudi Arabia, and found that the collaboration of pharmacists with nurses and other healthcare professionals in providing accessible and culturally appropriate medication education and support was associated with improved patient understanding, adherence, and satisfaction with pharmacy services.

These findings suggest that interprofessional collaboration between pharmacy and nursing has a significant and positive impact on pharmacovigilance and medication safety practices and outcomes in Saudi Arabia. The studies also highlight the importance of fostering a culture of collaboration, communication, and continuous learning among pharmacy and nursing professionals, as well as other healthcare team members, patients, and stakeholders, to optimize the benefits and sustainability of interprofessional collaboration in the Saudi healthcare context.

## **5. Discussion**

This systematic review synthesized the evidence on the current state, challenges, and opportunities of pharmacovigilance and medication safety practices in Saudi Arabia, and the role of interprofessional collaboration between pharmacy and nursing in supporting the healthcare transformation goals. The findings suggest that pharmacovigilance and medication safety practices in Saudi Arabia are evolving and improving, but still face significant gaps and barriers at the individual, organizational, and systemic levels, such as underreporting of adverse drug reactions, limited knowledge and skills among healthcare

professionals, lack of standardized protocols and systems, and cultural and communication challenges. The review also identified several enablers and strategies for enhancing pharmacovigilance and medication safety, such as regulatory support, technology adoption, education and training, interprofessional collaboration, and patient engagement, which have the potential to improve the detection, reporting, and prevention of adverse drug reactions and medication errors, and to promote a culture of safety and quality in the Saudi healthcare system.

The findings of this review are consistent with the global literature on the importance and challenges of pharmacovigilance and medication safety practices in healthcare settings. Studies from other countries, such as the United States (Woo et al., 2015), the United Kingdom (Cousins et al., 2012), and Australia (Roughead et al., 2016), have similarly highlighted the prevalence and impact of adverse drug reactions and medication errors on patient safety, healthcare costs, and quality of care, as well as the need for effective surveillance, reporting, and prevention strategies, and the collaboration of healthcare professionals, policymakers, and stakeholders in improving medication safety. These studies have also emphasized the role of technology, education, and patient engagement in enhancing the efficiency, effectiveness, and responsiveness of pharmacovigilance and medication safety systems to the changing healthcare needs and contexts.

However, the review also identified some unique aspects and considerations for pharmacovigilance and medication safety practices in the Saudi context, which reflect the specific cultural, religious, and social factors influencing the healthcare system and the pharmacy and nursing professions in the country. The studies highlighted the importance of aligning pharmacovigilance and medication safety practices with the Islamic principles and values, such as beneficence, non-maleficence, and justice, as well as the cultural norms and expectations around medication use, disclosure, and decision-making (Aljadhey et al., 2015). The studies also emphasized the need for culturally sensitive and linguistically appropriate approaches to medication safety education, communication, and support, that address the diversity and needs of the Saudi patient population and the healthcare workforce (Alshammari et al., 2015).

The review has several strengths, including the comprehensive search strategy, the inclusion of diverse study designs and settings, and the use of standardized quality assessment tools and narrative synthesis methods. However, the review also has some limitations, such as the potential for publication and language bias, the heterogeneity of the included studies, and the lack of meta-analysis due to the variation in outcomes and measures. These limitations should be considered when interpreting the findings and generalizing them to other contexts.

Despite these limitations, the review provides valuable insights and recommendations for policy, practice, and research to strengthen the pharmacovigilance and medication safety infrastructure in Saudi Arabia, and to leverage the expertise and partnership of pharmacy and nursing professionals in driving the healthcare transformation. At the policy level, there is a need for national guidelines, standards, and regulations that define the roles, responsibilities, and competencies of pharmacy and nursing professionals in pharmacovigilance and medication safety, as well as the mechanisms for their education, training, and professional development (Alshammari et al., 2016). At the practice level, there is a need for the implementation of evidence-based interventions and models that enhance the detection, reporting, and prevention of adverse drug reactions and medication errors, such as medication reconciliation, adverse drug reaction reporting systems, and medication safety education and counseling (Alshehri et al., 2022). At the research level, there is a need for more rigorous and context-specific studies that evaluate the effectiveness, feasibility, and sustainability of pharmacovigilance and medication safety practices and collaborations, as well as the strategies for scaling up and translating the evidence into policy and practice (Alghamdi & Urden, 2016).

## **6. Conclusion**

In conclusion, this systematic review provides evidence on the current state, challenges, and opportunities of pharmacovigilance and medication safety practices in Saudi Arabia, and the role of interprofessional collaboration between pharmacy and nursing in supporting the healthcare transformation goals. The

findings highlight the gaps and barriers in pharmacovigilance and medication safety practices, such as underreporting of adverse drug reactions, limited knowledge and skills among healthcare professionals, lack of standardized protocols and systems, and cultural and communication challenges, as well as the enablers and strategies for enhancing these practices, such as regulatory support, technology adoption, education and training, interprofessional collaboration, and patient engagement.

The review emphasizes the importance of investing in pharmacy and nursing education, research, and practice to drive the development and implementation of effective and sustainable pharmacovigilance and medication safety interventions and collaborations, that are responsive to the healthcare needs and preferences of the Saudi population, and that contribute to the achievement of the national healthcare transformation goals. It also underscores the need for interprofessional and cross-sectoral partnership and coordination, as well as patient and community engagement, to create an enabling environment for pharmacovigilance and medication safety, and to optimize the value and impact of pharmacy and nursing professionals in improving the quality, safety, and outcomes of healthcare services in Saudi Arabia.

As Saudi Arabia continues to implement its Vision 2030 and to invest in the development of a skilled and sustainable healthcare workforce, pharmacovigilance and medication safety offer a promising and essential approach to ensure the safe and appropriate use of medications, and to prevent the occurrence of adverse drug reactions and medication errors. By empowering pharmacy and nursing professionals to lead the way in detecting, reporting, and preventing medication safety issues, in collaboration with other healthcare professionals, policymakers, and stakeholders, Saudi Arabia can achieve its vision of a world-class healthcare system that promotes the health and well-being of its population, and that positions the pharmacy and nursing professions as key drivers of healthcare excellence and innovation.

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